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SENATE

REPORT
No. 98-108

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT

MAY 16, 1983.—Ordered to be printed

Mr. PACKWOOD, from the Committee on Commerce, Science, and Transportation, submitted the following

REPORT

[To accompany S. 1096]

The Committee on Commerce, Science, and Transportation, to which was referred the bill (S. 1096) to authorize appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities and research and program management, and for other purposes, having considered the same, reports favorably thereon with amendments and recommends that the bill do pass.

PURPOSE OF THE BILL

The purpose of this bill is to authorize appropriations to the National Aeronautics and Space Administration (NASA) totaling $7,278,100,000 for fiscal year 1984 as follows:

	Budget request	Committee authorization
Fiscal year 1984:		
Research and development	$5,708,500,000	$5,838,500,000
Construction of facilities	150,500,000	142,100,000
Research and program management	1,247,500,000	1,247,500,000

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COMMITTEE ADJUSTMENTS TO NASA REQUEST FOR FISCAL YEAR 1984—SUMMARY

Fiscal year 1984	Administration request	Committee authorization
Research and development:		
Space transportation capability development	$1,927,400,000	$2,022,400,000
Space transportation operations	1,570,600,000	1,535,600,000
Physics and astronomy	514,600,000	558,600,000
Planetary exploration	205,400,000	215,400,000
Life sciences	59,000,000	59,000,000
Space applications	289,000,000	321,000,000
Technology utilization	4,000,000	10,000,000
Aeronautical research and technology	300,300,000	328,300,000
Space research and technology	138,000,000	138,000,000
Tracking and data acquisition	700,200,000	700,200,000
Total	5,708,500,000	5,888,500,000
Construction of facilities	150,500,000	142,100,000
Research and program management	1,247,500,000	1,247,500,000
Grand total	7,106,500,000	7,278,100,000

LEGISLATIVE HISTORY

On February 25, 1983, the fiscal year 1984 budget request for NASA was submitted to Congress. The Committee considered the budget request in hearings on March 8, 9, and 15. Testimony was received from the NASA Administrator and Deputy Administrator and from representatives of the Department of Defense (DOD), the aerospace industry, the space science and applications communities, and other outside witnesses. Senator Gorton, along with Senators Packwood and Danforth, introduced S. 1096 the National Aeronautics and Space Administration Authorization Act of 1984, which was referred to the Committee on Commerce, Science, and Transportation.

On April 21, 1983, the Committee considered S. 1096 and ordered it reported without amendment.

SUMMARY OF MAJOR PROVISIONS

For fiscal year 1984, the Committee's NASA authorization bill authorizes $7,278,100,000, of which $5,888,500,000 is for research and development, $142,100,000 is for construction of facilities, and $1,247,500,000 is for research and program management.

Within the total space transportation systems budget of $3,558 million, the space transportation system capability development program is funded at a level of $2,022,400,000 to complete the production of the third and fourth Space Shuttle orbiters and to initiate procurement in fiscal year 1984 for the fifth orbiter, a position the Committee has supported in the past. This funding also supports the production of the main engines, the solid rocket booster (SRB), and the external tank (ET), in addition to providing critical spares for the Shuttle.

Also, within the total space transportation system budget, the Committee has authorized $1,535,600,000 for space transportation operations to provide for eight to nine Shuttle launches in fiscal

year 1984 and the continued procurement of the Delta expendable launch vehicles (ELV's) in fiscal year 1984.

The budget for space science programs in fiscal year 1984 is $833 million, compared to $683,100,000 in fiscal year 1983. This increase is made up largely of additions to research and analysis programs in physics and astronomy and in planetary exploration and to the Space Telescope project to meet the budget overruns for the project. The Solar Optical Telescope is delayed by a decrease of $16 million from the administration's request.

The space applications funding for fiscal year 1984 is $321 million, compared to a fiscal year 1983 operating level of $351 million. There is a decrease of $46 million for LANDSAT-4 for which operational responsibility is being transferred to the National Oceanic and Atmospheric Administration (NOAA). There are, however, total increases of $32 million in the space applications programs for other remote sensing capabilities, technology transfer communications, and materials processing in space. The funding for technology utilization for fiscal year 1984 is $10 million, up 1 million from fiscal year 1983.

The Committee authorized $328,300,000 for aeronautical research and technology, compared to $280 million in fiscal year 1983. The increase of $48,300,000 in aeronautical research and technology is made of a $33,200,000 increase in systems technology and a $15,100,000 increase in research and technology base.

$138 million is authorized for space research and technology, a $15 million increase above the fiscal year 1983 level.

Tracking and data acquisition for fiscal year 1984 is $700,200,000, up from the fiscal year 1983 level of $498,900,000. Financing of the tracking and data relay satellite (TDRS) systems accounts for most of this increase.

The total research and development budget for the above-mentioned programs for fiscal year 1984 is $5,888,500,000 compared to the fiscal year 1983 funding level of $5,542,800,000.

The Committee recommendation for construction of facilities for fiscal year 1984 is $142,100,000 and for research and program management, $1,247,500,000.

S. 1096, as reported, includes language which requires the approval by this Committee and Congress of any transfer of the ownership or management of our civil remote sensing satellite systems to the private sector.

The bill also includes language which requires approval by this Committee and the House Science and Technology Committee of any administration decision to commercialize expendable launch vehicles.

RESEARCH AND DEVELOPMENT

Space Transportation Systems—$3,558,000,000

SPACE TRANSPORTATION CAPABILITY DEVELOPMENT $2,022,400,000

The Committee has authorized $2,022,400,000 in fiscal year 1984 for space transportation capability development, compared to the administration request of $1,927,400,000. Of this $95 million dollar increase, $85 million, coupled with the administration request of

$100 million for spare parts, is for the initiation of the procurement of a fifth Space Shuttle orbiter. $5 million is for the advanced program budget for additional space station studies, and antoher $5 million is for the teleoperator maneuvering system (TMS).

Summary of funding levels, fiscal year 1984

Shuttle production and capability development	$1,585,000,000
Upper stages	143,200,000
Spacelab	119,600,000
Engineering and technical base	93,100,000
Payload operations and support equipment	53,200,000
Advanced programs	20,000,000
Tethered satellite system	3,300,000
Teleoperator maneuvering system	5,000,000
Total	2,022,400,000

The Space Shuttle is the key element of a versatile space transportation system (STS) that is available to a wide variety of national and international users. The Space Shuttle is the first reusable space vehicle and is configured to carry many different types of space applications, scientific, and national security payloads. This Space Shuttle offers unique capabilities that cannot be achieved with today's expendable launch vehicles—to retrieve payloads from orbit for reuse; to service and repair satellites in space; to transport to orbit, operate, and return space laboratories; to transport materials and equipment to orbit; and to perform rescue missions.

Shuttle production and capability development provides for the national fleet of Space Shuttle orbiters, including main engines, and provides for the launch site and mission operations control requirements, spares, production, tooling, and related supporting activities to meet appropriate national needs. More specifically, this line item contains the orbiter production contract for the third and fourth Shuttle orbiters and the changeover of the first orbiter into its operational configuration; the continuing capability development tasks for the orbiter, main engine, external tank (ET) and solid rocket booster (SRB); the provision of the second line of processing stations and equipment for launch and landing; the development of the filament wound case (FWC) solid rocket booster; the lay-in of spares and the ground support equipment; and the production rate tooling for the ET and SRB. Equipment modifications to two orbiters, mobile launchers, and launch pads for the 1986 launches of the Centaur as a space transportation system upper stage are also funded under this budget item. The second phase of development of the mission control center (MCC Level II), operations effectiveness studies, and changes and systems upgrading are also provided for under Shuttle production and capability development.

The upper stages program includes the effort necessary to provide upper stages for use with the Space Shuttle to place payloads in orbits and trajectories beyond the capability of the Shuttle alone, primarily for planetary and geosynchronous missions. Current developments include the two-stage configuration of the inertial upper stage (IUS), and the modification of the Centaur for use in the Shuttle.

The engineering and technical base provides the core capability for the engineering, scientific, and technical support required at the Johnson Space Center (JSC), the Kennedy Space Center (KSC), the Marshall Space Flight Center (MSFC), and the National Space Technology Laboratories (NSTL) for space transportation systems research and development activities.

The Spacelab is a major element of the STS and provides a versatile, reusable laboratory which will be flown to and from Earth orbit in the Shuttle orbiter cargo bay. The program is being carried out jointly by NASA and the European Space Agency (ESA). NASA's support of the Spacelab development effort includes hardware and system activation efforts which ensure Spacelab compatibility with the orbiter, leading to an operational capability.

Payload operations and support equipment provides for developing and placing into operational status the ground and flight systems necessary to support the NASA payloads during pre-launch processing, onorbit mission operations, and, when appropriate, post-landing processing.

The advanced programs effort identifies potential future space programs and provides technical as well as programmatic data for their definition and evaluation. In support of this effort, advanced development activities are conducted to provide a basis for obtaining significant performance and reliability improvements and reducing future program risks and development costs through the effective use of new technology. Key elements of this activity are the numerous studies related to space stations.

The tethered satellite system (TSS) will provide a new capability for conducting space experiments at distances up to 100 kilometers from the Shuttle orbiter while being held in a fixed position relative to the orbiter. This program will be undertaken in conjunction with the Italian Government.

The orbiter production activities provide for the completion of fabrication and delivery of the four-orbiter fleet. Columbia (OV-102) was used to fly the four orbital flight tests and first operational mission; Challenger's (OV-099) maiden voyage was STS-6; and, Discovery (OV-103) and Atlantis (OV-104) are scheduled for delivery in September 1983 and December 1984, respectively. Progress on OV-103 and OV-104 to date indicates that the planned delivery dates can be achieved. Modifications to enable the launch of the Centaur upper stage on OV-099 and OV-104 are underway; the modification kits will be installed in fiscal year 1986. The Columbia (OV-102) is now undergoing a period of modification at KSC in order to prepare the vehicle for the launch of the first Spacelab mission, currently planned for September 1983. The Columbia will be modified to full operational configuration in fiscal year 1985, although these modifications may be rescheduled for an earlier date pending an evaluation of the training and vehicle processing requirements associated with maintaining orbiters having two different configurations. Orbiter spares procurements to establish the required level of spares availability at the KSC launch site are continuing, and close attention is being given to the estimated spares requirements as a function of the experience being gained during operations. The administration has authorized the inclusion in this budget request of the amounts required to procure extensive spares

to ensure the operational viability of four-orbiter fleet; initiation of procurement is planned for fiscal year 1983. However, the Committee recommends the initiation in fiscal year 1984 of procurement of a fifth orbiter, using the administration's $100 million for spare parts plus the additional $85 million in the Committee request.

At KSC the second line of vehicle processing stations is being phased in to support launch processing of two or more orbiters simultaneously. The second mobile launcher platform was brought online in August 1982 and the second bay of the orbiter processing facility became operational in June 1982. The second set of high bays in the vehicle assembly building (VAB) will be ready for operations in the summer of 1983, the launch processing system's software production capability and second firing room will be ready in the fall of 1983, and the SRB processing and storage facility will be available in early 1984. The second launch pad (Pad B) is now planned to be operational in January 1986, consistent with the requirements to support the launches of the Galileo and International Solar Polar Mission (ISPM) in May–June 1986. The third mobile launcher platform, on which design work was initiated in 1982, is planned for a September 1986 readiness date. Modifications to the mobile launcher platforms (MLP–1 and MLP–2) and to launch pad systems to be compatible with the use of the Centaur as a Shuttle upper stage were authorized in 1982 and the design work is underway.

Development testing and production continue on the Space Shuttle main engine (SSME) in its full power level (FPL) configuration. NASA has decided to wait until launches begin at Vandenberg Air Force Base in 1985 to operate the Shuttle main engines at full power (109 percent). Production engine delivery schedules have been adjusted for the addition of an engine (2027) to the production sequence to replace engine 2013, destroyed in an early FPL certification test. Engine test incidents in 1982 indicated the need for additional hardware fabrication to support the on-going FPL test schedules. Replacement of the hardware lost during the past year and provisions for long-lead hardware to support the ground test program are reflected in the current estimates for fiscal year 1983 and in the fiscal year 1984 request. Three different main engine problems contributed to a launch delay of approximately three months for the STS–6 flight. NASA has instituted additional engine tests in its engine testing protocol which should prevent these same problems from creating similar launch delays. On the positive side, however, the performance of the main engines in their first six flights has validated the concept of a reusable rocket engine having high thrust capability.

The experience with the SRB's during the initial flights has revealed the need for design improvements to reduce the amount of water impact damage to the SRB's aft end, particularly to the hydraulic power units mounted internally to the aft skirt. Interim fixes have been pursued, resulting in reduced damage to the SRB's on STS–5. Work is underway on new designs to provide a long-term solution.

The ET performance on its first six flights was excellent. The delivery of the new lightweight tank was made on schedule and with greater weight savings than initially baselined. The first flight of

the lightweight tank was STS–6. Emphasis continues on the cost-reduction/producibility/production readiness efforts to identify and implement the associated flow and processing improvements anticipated in the projections of operational tank costs and required to meet the increasing production build rates. Rate tooling for both the ET and SRB is based on maintaining a capability to increase production above that rate. Effort continues to identify "choke points" where additional tools or cells will be required at the Michoud Assembly Facility to meet the current capability requirement. Preliminary reviews indicate that additional tools and equipment will be necessary in a number of manufacturing areas; the preliminary findings will be defined in detail along with the implementation schedule and funding requirements. Based on fabrication and flight experience, there is a reduction in the amount in the amount of super lightweight ablator (SLA) required on the tank, and a number of SLA application tools have been eliminated.

The development of the filament wound case (FWC) for the SRB has been initiated to improve the performance of the Space Shuttle for high performance missions. The filament wound case contractor has been selected. The expected weight reduction in the SRB by using the FWC in place of the steel cases is estimated at 66,000 pounds, resulting in a payload capability improvement of approximately 5,500 pounds. Integration analyses were started in 1982 to determine the loads effects on the orbiter and the ET and to analyze the lift-off loads induced by the launch platform at the Vandenberg launch site.

In upper stages, a joint development program with the DOD, has been initiated for the use of the Centaur as a STS upper stage. The Centaur/STS will be a wide-body derivative of the Centaur stage used in the Atlas-Centaur program. The common vehicle, designated Centaur, will accommodate a 40-foot long, approximately 10,000-pound payload in the bay of the orbiter, and be capable of placing it into geosynchronous orbit. A longer version of the Centaur-G, known as G-prime, is being developed by NASA for planetary missions. The Air Force and NASA will equally share common design and development costs for the Centaur-G. An agreement on the Centaur was signed by the Air Force and NASA in November 1982. The Centaur-G-prime will be first used for launching the Galileo and ISPM spacecraft in 1986, replacing the previously planned planetary version of the inertial upper stage (IUS).

Another adjustment to the IUS production program will result in a reduction in the number of vehicles delivered to NASA for the launch of the tracking and data relay satellites (TDRSS). As a result of the restructuring of the tracking and data relay satellite system (TDRSS) service agreement to make the TDRSS a dedicated Government system, the near-term requirement for IUS vehicles to support the TDRSS launches has been reduced from six vehicles to four. The Air Force is planing to complete the two vehicles no longer required by NASA and to assign them to DOD missions. In the initial TDRS/IUS launch on STS–6, the TDRS was launched into the wrong orbit due to a malfunction of the IUS. NASA may delay the launch of the second TDRS; and scheduled for an STS–8 launch in August 1983 until the problems with the IUS are corrected. Two additional spacecraft will be launched to complete the

TDRSS in-orbit constellation. A ground spare spacecraft and IUS vehicle will be maintained to provide the capability to replace an orbital spacecraft in the event of a spacecraft failure.

The initial Spacelab flight units (module, pallets, and igloo) and ground equipment were delivered by the ESA in 1982. The first crew transfer tunnel, a U.S. development responsibility, was delivered to KSC in December 1982. Fabrication of the verification flight instrumentation for the initial Spacelab mission has now been completed, and integration of the software for the Spacelab simulator being used in training for this mission was also completed. Preparations for the flight of Spacelab–1 in September 1983 are well underway.

In advanced programs, mission analysis studies are in process for a possible future space station. A space station task force has been formed within NASA to review the merits and technical feasibility of establishing a permanent manned presence in space. Contractor mission analyses were initiated in 1982, and preliminary reports have been made by the contractor teams; final reports will be completed in mid-1983. In other advanced programs areas, the development of the tethered satellite system will continue, leading to the initiation of hardware development in fiscal year 1984. Preliminary definition of advanced transportation vehicle concepts, including orbital transfer vehicles, teleoperator maneuvering vehicles, and Shuttle derived launch vehicles, is also being conducted. Work is proceeding on the investigation of advanced systems, tools, and techniques for placement, retrieval, and maintenance/repair of spacecraft.

In payload operations and support equipment, payload integration support and payload-related hardware are developed and furnished for NASA payloads. A key activity currently underway is the support of the retrieval/repair mission for the solar maximum mission spacecraft, which is being undertaken with funding supplied by both NASA and the DOD. This mission is currently planned for mid-1984. Multimission payload equipment being developed includes a payload bay bridge structure to carry small payloads, apparatus for providing cooling of the heat generated in the orbiter bay by the radioisotope thermal generators (RTG's) used for planetary missions, and a standard mission cable wire harness for mixed cargos. The payload operations control center (POCC) at JSC is presently being readied to support the operations of the Spacelab–1 mission in September 1983.

SPACE TRANSPORTATION OPERATIONS—$1,535,600,000

The Committee authorizes $1,535,600,000 for fiscal year 1984, $35.0 million less than the administration request.

Summary of Finding Levels, fiscal year 1984

Shuttle operations; flight operators; flight hardware; launch and landing operations	$1,485,600,000
Expandable launch vehicles (Delta)	50,000,000
Total	1,535,600,000

Space transportation operations provides the standard operations support services for both of the primary U.S. space launch systems:

the Space Shuttle and the expendable launch vehicles. Within Shuttle operations, external tank and solid rocket booster flight hardware is produced; operations spare hardware is provisioned, overhauled and repaired; and the manpower, propellants, and other materials are furnished to conduct and support both flight and ground (launch and landing) operations. The Space Shuttle operations program provides for the launch of NASA, Department of Defense (DOD), other U.S. Government, domestic commerical and international missions. Five flights are planned for launch in fiscal year 1983. Eight to nine missions are planned in fiscal year 1984, depending upon reflight requirements and identification of new mission requirements. The Vandenberg launch site is planned to be activated on a schedule which would enable a first flight to take place as early as late 1985.

The Space Shuttle provides launch services to non-NASA users on a reimbursable basis; the amount paid by users is tied to the size of the user's payload and the services required to support his launch requirements. For flights through fiscal year 1985, the computation is based on a full mission cost for standard launch of $18 million per flight in 1975 dollars; for fiscal years 1986–88 flights, the charge will increase to $38 million in 1975 dollars, or approximately $71 million in fiscal year 1982 dollars. The budget is based on charging DOD $16 million in 1975 dollars for dedicated flights in fiscal year 1984 and fiscal year 1985, and $29,800,000 in 1975 dollars for flights during fiscal years 1986–88. The Bureau of Labor Statistics computation of compensation per hour is used as the index for escalating 1975 dollars to current dollars for billing purposes. The projected receipts from reimbursable users are applied against total program funding requirements to derive the amount of appropriated funds requested.

The Shuttle operations budget request funds three principal areas: flight operations, flight hardware, and launch and landing operations. Under flight operations is the training, mission control, and flight operations planning, payload integration analysis, mission analysis, and post flight anomaly resolution; flight hardware includes the external tanks (ET), solid rocket boosters (SRB), main engine flight spares, orbiter spares (including overhaul, repair and logistics), and Marshall Space Flight Center (MSFC) systems support; and launch and landing operations covers Kennedy Space Center (KSC) operations, contingency landing site provisions, and Dryden Flight Research Facility (DFRF) operations.

The objective of the expendable launch vehicles program is to provide for the centralized procurement of launch vehicles and the launch support services for NASA's automated spacecraft missions, as well as for other agencies and organizations utilizing these systems and services on a reimbursable basis.

The expendable launch vehicle transportation systems consist of the Scout, the Atlas Centaur, the Delta, and the Atlas-F vehicles. This family of launch vehicles has been developed to support NASA's automated spacecraft launch requirements and, on both a cooperative and a reimbursable basis, to support other government, international, and commercial agencies and organizations. The expendable launch vehicle program includes the procurement of vehicle hardware, launch services, engineering, and maintenance sup-

port, including the necessary reliability improvements of the launch vehicle, and the ancillary ground equipment. In fiscal year 1984, only the Delta requires appropriated funding; the Scout, Atlas-Centaur, and Atlas-F are on a fully reimbursable basis.

Expendable launch vehicles are launched from sites located at the Eastern Space and Missile Center (WSMC) in Florida, the Western Space and Missile Center (WSMC) in California, the Wallops Flight Facility in Virginia, and the San Marco Platform off the African coast near Kenya.

Committee comment

While NASA declared the Space Shuttle operational last November, much remains to be demonstrated to ensure reliability and full utilization of the designed capabilities. Competition from other launch services will require that the Space Shuttle operate on a cost competitive basis and on a dependable, predictable schedule.

As a result, the Committee addressed the following questions:

(1) The appropriate size of the orbiter fleet to meet the defense and other governmental demands as well as commercial opportunities for the STS.

(2) The place of expendable launch vehicles (ELV's) during and after the phase-in of the STS.

(3) The implications for the orbiter fleet of a decision to proceed with a permanent space platform or station.

The Committee has authorized $85 million in addition to the $100 million proposed by the administration for spare parts for a five orbiter fleet. This $185 million is committed to procurement of a fifth orbiter and is intended to maintain a schedule for acquisition of critical parts leading to delivery of another orbiter in late 1988 or early 1989.

This position is consistent with that which the Committee has held in past years. The Committee continues to believe that a Shuttle fleet of five orbiters is economically prudent and in the national interest. The cost reductions associated with Shuttle flights can only be realized through a higher flight rate which in turn can only occur with sufficient orbiters.

A report released by the National Research Council in April, 1983, estimates that in the 1990's a 4-orbiter fleet will be capable of 17 to 25 flights per year while 22 to 31 flights would be possible with a 5 orbiter fleet. This projection assumes that one orbiter will be dedicated to the U.S. Air Force at Vandenberg AFB, and optimistically, that no circumstances will take an orbiter out of service more frequently than the 5 months maintenance scheduled after every 15–25 missions. Our experiences to date, particularly with the Shuttle main engines on STS–6, leaves uncertain the likely service requirements of the Shuttle. Thus, the Committee believes that a five-orbiter fleet is marginally capable for the Nation's space transportation and services needs for the remainder of the century.

NASA's current goal is an annual launch rate of 24 by 1987. The agency's assumptions for meeting this goal are optimistic and the prospects marginal, at best by the NRC projections. At the same time, the per flight costs of the Shuttle cannot become competitive until the flight rate achieves or exceeds the 24 flights proposed by NASA.

Conceivably, a smaller fleet size could accomodate the defense and other requirements of the Government. Under this approach, commercial services would be provided primarily by other launch services, private or foreign. This was not the expectation by the Congress for the STS. The Nation cannot fully realize the intended benefits of the STS and recover the substantial public investment which has been made until the launch rate is increased and the unique in orbit and return capabilities of the Shuttle are utilized commercially. Furthermore, that commercial requirement is only now taking shape and is likely to expand heavily as the certainty of Shuttle services is established.

Closely related to the decision on the orbiter fleet size is that of the future of the expendable launch vehicles. The end of NASA's procurement of Delta and Atlas-Centaur and of DOD's procurement of Titan launch vehicles have been scheduled. These decisions are consistent with the original intention of making the Shuttle the Nation's sole space transportation system. However, the ELV's remain proven systems which private sector interests see as cost competitive for the limited back-up launch services for which they are designed.

With an operational five orbiter shuttle fleet, the Committee anticipates that government, commercial and international demands for transportation can be met in the foreseeable future. In time there likely could be little or no need for the existing expendable launch vehicles (ELVs). However, the Committee is aware that there will be a demand for backup capability using ELVs in the near term and the French Ariane rocket will be available in that period. Since the U.S. Government foresees phasing out of the ELV market, the Committee is encouraged that there is some private sector interest in keeping the production lines open. The Committee is fully supportive of efforts by the private sector to invest and seek commercial opportunities in space. The Committee wants to encourage those private sector initiatives that will augment the anticipated Shuttle fleet and compete with foreign launch capabilities. Such an imminent opportunity for U.S. ELVs is in the Intelsat communications market. The Committee expects the administration to develop expeditiously a policy and procedures whereby the private sector is able to compete for this market.

In developing a proposed policy and reaching a decison on commercialization of ELVs, the Committee expects to be fully informed and a partner in any decision reached. The Committee regrets the significant delays in the administration's action on this issue and the lack of opportunity for congressional input. There are a number of questions regarding any commercialization policy such as the relationship of ELVs to the shuttle fleet, the establishment of equitable costs to the private sector and the regulatory framework for private launch capabilities. The Committee expects to review the administration's proposed policy on a basis comparable to the procedure established under section 104 of this bill.

The Committee generally accepts that the next major national initiative in space could be a permanent platform or station, very likely manned. Realization of such capability will almost certainly expand the requirements for an orbiter fleet beyond those which the four vehicles can provide.

An additional $5 million has been added to the $12 million which the administration proposed for space station studies. At this level NASA should be able to retain involvement of the critical agency and contractor teams which have been studying the requirements for such a permanent space presence. The Committee urges NASA to direct its space stations work toward increased contractor effort in space station system and subsystem definition, trade and supporting studies, and advanced development.

The teleoperator maneuvering system (TMS) is a concept which would greatly expand the servicing capabilities of the Shuttle for on orbit placement and retrieval of space payloads. Anticipated applications include materials processing, advanced space observatory servicing, debris capture, cryogenic servicing and support of space station assembly. These capabilities will become increasingly important as a more long-lived, multifunctional, complex payloads we launched.

Due to the fiscal year 1983 Shuttle operations operating plan exceeding the actual needs of the operations, this Committee has reduced the fiscal year 1984 administration request for Shuttle operations by $35 million. Also, the Committee is aware of past indications by the DOD that they are willing to transfer some funds to NASA for Shuttle operations.

The Committee is concerned over the problems in the Space Shuttle main engines that accounted for most of the approximately 3-month delay in the launch of STS–6. While NASA has subsequently introduced additional tests in its engine testing protocol, the Committee, nevertheless, is watchful of the possibility of modifications to the main engines and the requirement for additional engine spares. The Committee anticipates that these requirements will be accommodated within NASA's space transportation operations budget.

Space Sciences—$833,000,000

The Committee authorization for the space science—physics and astronomy, planetary exploration, life sciences—is $833 million, $54 million above the fiscal year 1984 administration request.

Physics and Astronomy—$558,600,000

The Committee recommends $558,600,000, compared to the administration's request of $514,600,000. This $44 million increase is accounted for in the following Committee authorization changes to the administration budget:

[In millions of dollars]

	Administration request	Committee authorized
Mission operations and data analysis (HEAO-2 data analysis)	2.8	3.8
Research and analysis	29.8	33.8
Space telescope project	120.6	170.6
Shuttle/spacelab payload development and mission management	92.9	81.9
Solar optical telescope	(16.0)	(0.0)
Space PLasma Lab	(3.0)	(8.0)

Summary of funding levels, fiscal year 1984

Space Telescope development	$170,600,000
Gamma Ray Observatory development	89,800,000
Shuttle/Spacelab payload development and mission management	81,900,000
Explorer development	48,700,000
Mission operations and data analysis	80,500,000
Research and analysis	33,800,000
Suborbital programs	53,300,000
Total	558,600,000

Launch schedule

Project and mission:	Year
Space Telescope: ST	1986
International solar polar mission: ISPM (ESA spacecraft only)	1986
Gamma Ray Observatory	1988
Spacelab:	
Spacelab-1	1983
Spacelab-2	1984
Space shuttle orbital flight test payloads: OSS-3	1985
Explorers:	
San Marco-D/Low orbit	1982
Infrared astronomy satellite	1982
Cosmic ray isotope experiment	1982
Active magnetospheric particle tracer explorer	1984
Cosmic background explorer	1987
Extreme ultraviolet explorer	1988
Suborbital programs:	
Sounding rockets—About 50 launches per year	
Balloon flights—About 20 launches per year	
Airborne—About 65 flights per year of Kuiper Airborne Observatory	

Note.—Shuttle/Spacelab payloads in support of space science objectives will build to a flight rate of approximately 2.5 equivalent Spacelab missions per year by 1985.

The major objective of the physics and astronomy program is to increase our knowledge and understanding of the solar-terrestrial environment and of the origin, evolution, structure and composition of the universe, including the Sun, the stars, and the other celestial bodies. Space based research is being conducted to investigate the physics, chemistry and the transport processes occurring in the Earth's mangetosphere, ionosphere, and atmosphere, and the responses of the transport processes to solar phenomena and variability; the structure and dynamics of the Sun and its long- and short-term variations; cosmic ray, X-ray, ultraviolet, optical infrared, and radio emissions from stars, interstellar gas and dust, pulsars, neutron stars, quasars, black holes and other celestial sources; and the laws governing the interactions and processes occurring in the universe. Many of the phenomena being investigated are not detectable from ground-based observatories because of the absorbing or distorting effects of the Earth's atmosphere.

To achieve the objectives of the physics and astronomy program, NASA employs theoretical and laboratory research; aircraft, balloon and sounding rocket flights; Shuttle/Spacelab flights; and free-flying spacecraft. Research teams involved in this program are located at universities, industrial laboratories, NASA field centers, and other government laboratories. The scientific information obtained and the technology developed in this program are made available to the scientific communities for the application to and the advancement of scientific knowledge, education and technology.

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The physics and astronomy missions undertaken to date have been extraordinarily successful. Although the last two of the highly successful High Energy Astronomy Observatories (HEAO's) have ceased operation in the last year, three missions continue to bring us a rich harvest of data—the International Ultraviolet Explorer (IUE), the International Sun-Earth Explorer (ISEE), and the Dynamics Explorer (DE) missions. In addition, the Solar Maximum Mission (SMM), prior to its partial failure in December of 1980 has given us a new picture of the sequence of events that occur in a flare of the Sun; it also measured nuclear processes that accompany these energetic events. After observing a large number of flares, data from the solar maximum mission have contributed significantly to the development of a new model of how solar flares occur.

The Space Telescope will make a major contribution to understanding the stars and galaxies, the nature and behavior of the gas and dust between them, and the broad question of the origin and scale of the universe. Operating in space above the atmospheric veil surrounding the Earth, the Space Telescope will increase by several hundredfold the volume of space accessible for observations. With its significant improvements in resolution and precision in light sensitivity and in wavelength coverage, the Space Telescope will permit scientists to conduct investigations that could never be carried out using ground-based observatories due to the obscuring and distorting effects of the Earth's atmosphere. The Space Telescope will enhance the ability of astronomers to study radiation in the visible and ultraviolet regions of the spectrum. It will be more sensitive than ground-based telescopes and will record greater detail about the objects under study. It will make possible observation of objects so remote that the light will have taken many billions of years to reach the Earth. As a result, we will be able to look far into the distant past of our universe. The Space Telescope will also contribute significantly to the study of the early state of stars and the formation of solar systems, as well as to the observation of such highly-evolved objects as supernova remmants and white dwarfs stars. With the Space Telescope, we may be able to determine the nature of quasars and the processes by which they emit such enormous amounts of energy, and it may also be possible to determine whether some nearby stars have planetary systems. The Space Telescope will be an automated observatory, delivered into orbit by the Space Shuttle. Data from its scientific instruments will be transmitted to Earth via the tracking and data relay satellite system. The Space Telescope design will permit in-orbit maintenance, repair, and retrieval by the Space Shuttle for return to Earth, refurbishment, and reuse.

Launch of the Space Telescope is now anticipated for 1986. The fiscal year 1983 funding will continue to cover the fabrication of the telescope. Detailed design and development of the optical telescope assembly, is occurring during 1983. Also, assembly and test of the scientific instruments will be initiated and the critical design review for the support systems module will take place. In fiscal year 1984, funding is required to continue the development and manufacture of the optical telescope assembly. This funding will also support the final integration and testing of the support systems module and the scientific instruments.

The objective of the Gamma Ray Observatory (GRO) mission is to measure gamma ray radiation from the universe and, thus, to explore the fundamental physical processes powering it. Certain celestial phenomena are accessible only at gamma ray energies. The observational objectives of the Gamma Ray Observatory are to search for direct evidence of the synthesis of the chemical elements; to observe high energy astrophysical processes occurring in supernovae, neutron stars and black holes; to locate gamma ray burst sources; to measure the diffuse gamma ray radiation for cosmological evidence of its origin; and to search for unique gamma ray emitting objects. Gamma rays represent one of the last frontiers of the electromagnetic spectrum to be explored because the required technology has only recently been developed. The low flux levels of gamma ray quanta, and the high background they produce through their interaction with the Earth's atmosphere, coupled with the demand for better spectral, spatial, and temporal resolution of source features, combine to require that large gamma ray instruments be flown in space for a prolonged period. Gamma rays provide unique information on the most intriguing astronomical objects yet discovered, including quasars, neutron stars, and black holes. Astronomy is now to the point where our understanding of these objects is being seriously impaired by lack of data in the gamma ray region of the spectrum. Comprehensive research in gamma ray astronomy has consistently been given high priority by the science community. The Gamma Ray Observatory will be launched by the Space Shuttle. The spacecraft is designed to accommodate several gamma ray instruments. It is planned that the instruments will have their principal axis pointing in the same direction, and the spacecraft will point these instruments in a fixed direction in space for long periods (hours to weeks).

GRO will begin development of spacecraft and instrument hardware during fiscal year 1984. The fiscal year 1984 funding is required to complete the detailed mechanical and electrical designs; complete the critical design reviews on the scientific instruments; and complete the spacecraft preliminary design review.

The objectives of Shuttle/Spacelab payload development and mission management are to acquire new knowledge in the disciplines of physics and astronomy and to manage the mission planning and execution of the complete NASA Spacelab payload program. The funding provides for the development of all physics and astronomy Spacelab experiments, the system management and engineering developing of the flight equipment and software, the payload specialist support, the physical integration of the payload with the Spacelab system, the operation of the payload during flight, the dissemination of data to experimenters, and the analysis of physics and astronomy flight data. Instruments to be flown on three missions primarily dedicated to physics and astronomy science are now under development. The OSS–1 pallet was flown on the STS–3 in 1982. The OSS–1 mission consisted of six instruments that gathered solar physics data, evaluated the Shuttle environment, and provided data on thermal control technology.

Spacelab-1, which will consist of a pressurized Spacelab module and a pallet, is scheduled for flight in 1983. The objectives of Spacelab-1 are to demonstrate the capabilities of the Spacelab system

and to obtain multidisciplinary scientific data with emphasis on atmospheric and space plasma physics. In 1983, the Spacelab-1 payload will be integrated with the Spacelab equipment and then into the Shuttle. Spacelab-2, an all pallet configuration, is scheduled to fly in early 1985. The objectives of Spacelab-2 are to verify the Spacelab igloo and pallet systems and to obtain scientific data, with emphasis on astrophysics and solar physics. The instrument pointing system, developed by the European Space Agency, will be used for the first time on the Spacelab-2 mission. During fiscal year 1983, development of the Spacelab-2 instruments will be completed and integration will be initiated. The OSS–3 mission is also under development leading to a launch scheduled for 1986. OSS–3 is a Spacelab pallet payload of three ultraviolet telescopes that will carry out ultraviolet imaging, spectrophotometry and polarimetry at resolutions and sensitivities previously unavailable. This payload will allow unique new scientific investigations of a broad range of objects from nearby comets and planets out to the most distant quasars. Data gathered by the OSS–3 mission will be used to define and direct future Space Telescope observations. The OSS–3 science instruments will be reflown on the Shuttle during the period of Halley's Comet for unique scientific observations of the comet from the near-Earth orbital environment.

The fiscal year 1984 budget request will allow continued mission management of ongoing NASA Shuttle/Spacelab missions including instrument development for physics and astronomy missions and Spacelab payload functions for nonphysics and astronomy missions in the life sciences, space applications and technology programs. Fiscal year 1984 funding is also required for data analysis from the Spacelab-1 mission, as well as integration and test activities on the Spacelab-2 payload, leading to a 1985 launch. Instrument development for the OSS–3 flight will be continued and early definition activities will be continued on the Shuttle Infrared Telescope Facility. Fiscal year 1984 funding is also required to define potential payloads for a future space station.

The Explorer program provides the principal means of conducting astronomical studies and long-term investigations of solar physics and of the near-Earth interplanetary environment having limited, specific objectives and not requiring major observatories. Included in the present program are missions to study atmospheric and manetospheric physics; the several magnetospheric boundaries; interplanetary phenomena; and X-ray, ultraviolet, and infrared astronomy. Studies are conducted to define future high priority science explorer missions. NASA engages in cooperative missions with other Federal agencies and other nations whenever such cooperation will assist in achieving NASA objectives. Solar terrestrial and atmospheric explorers provide the means for conducting studies of the Earth's near-space environment. The program requires a wide variety of satellites in orbits extending from the very lowest reaches of the upper atmosphere, to the interplanetary medium beyond the Earth's magnetosphere. Efforts in fiscal year 1983 include launch of the Infrared Astronomical Satellite (IRAS), launch of the San Marco-D (low orbit) mission and continuation of development on the Active Magnetospheric Particle Tracer Explorer. The San Marco-D mission, a cooperative project with Italy, will include

a group of U.S. experiments to study the relationship between solar activity and the Earth's meteorological phenomena. The Active Magnetospheric Particle Tracer Explorer, a cooperative project with the Republic of Germany, will involve the use of two spacecraft, one designed and built in the United States, to study the solar wind at the subsolar point and to identify particle entry windows, energization processes and transport processes into the magnetosphere.

Astrophysics explorers have been instrumental in conducting the first astronomical sky surveys in the gamma ray, X-ray, ultraviolet and low frequency radio regions of the electromagnetic spectrum. The Cosmic Ray Isotope Experiment, which was launched in May 1982 on a DOD spacecraft, is studying galactic cosmic rays, as well as nuclei accelerated from solar flares, in order to shed light on models of nucleosynthesis and to identify probable sources of cosmic ray nuclei. Development will continue on the Cosmic Background Explorer (COBE). COBE will carry out a definitive all-sky exploration of the diffuse cosmic background radiation of the universe between the wavelengths of 1 micrometer and 13 millimeters. The detailed information this mission will provide on the spectral and spatial distribution of low energy background radiation is expected to yield significant insights into basic cosmological questions of the origin and evolution of the universe.

ROSAT, a cooperative project between the Federal Republic of Germany and the United States, will perform high resolution imaging studies of the X-ray sky. The United States will provide a high resolution imaging instrument and launch services, and Germany will provide the spacecraft and instrumentation.

Fiscal year 1984 Explorer funding will provide for continued development activity on the AMPTE and COBE missions. Fiscal year 1984 funding will also provide for design and definition studies for future candidate missions, including the Extreme Ultraviolet Explorer (to be initiated in fiscal year 1984) and the X-Ray Timing Explorer. The Extreme Ultraviolet Explorer, the next candidate Explorer mission, is approaching readiness for a development start. This mission will carry out the first detailed all sky survey of ultraviolet radiation between 100 and 900 angstroms—a hitherto unexplored portion of the electromagnetic spectrum.

The purpose of the mission operations and data analysis effort is to conduct operations and to analyze data from the physics and astronomy satellites after launch. This program also supports the continued operation of a number of spacecraft, after their originally planned objectives have been achieved, for purposes of conducting specific investigations that have continuing, high scientific significance. The funding supports the data analysis activities of the many investigators at universities and other research organizations associated with astrophysics and solar terrestrial operational satellite projects. Actual satellite operation, including operation control centers and related data reduction and engineering support activities are typically carried out under a variety of mission support or center support contracts.

Several spacecraft remain operational and are providing valuable data. The International Ultraviolet Explorer continues to peform well, with a very productive guest investigator program. The solar

maximum mission (SMM) also continues to provide useful data, even though it is operating in a degraded mode. Mission operations and data analysis will continue for these missions through fiscal year 1983, as well as for the Infrared Astronomical Satellite, which was launched in early 1983. Fiscal year 1983 funding also supports activities leading to the retrieval/repair of the SMM spacecraft and science instruments in 1984. In addition to the normal support required for mission operations, the Space Telescope program encompasses several unique aspects which must be provided for well in advance of launch. The Space Telescope is designed for operation for more than a decade, based on in orbit maintenance, recovery, refurbishment, and relaunch and in orbit changeout of the scientific instruments. During the operational period, the Space Telescope will be used primarily by observers selected on the basis of proposals submitted in response to periodic solicitations. NASA has determined that the most efficient and scientifically satisfactory approach to science operations will involve establishment of an independent science institute which will operate under a long term contract with NASA. While NASA will retain operational responsibilities for the observatory, the institute will implement NASA policies in the areas of planning, management, and scheduling of the scientific operations of the Space Telescope.

Fiscal year 1984 funds will provide support for the basic mission operations and data analysis activities for the Infrared Astronomical Satellite and the Active Magnetospheric Particle Tracer Explorer, continued operations and data analysis activity for the International Ultraviolet Explorer, and continued analysis of the extensive data obtained by the High Energy Astronomy Observatory missions. Fiscal year 1984 funding will support the retrieval/repair of the solar maximum mission spacecraft and instruments, and will support the continued development of the Space Telescope. In fiscal year 1984, the development of mission operations procedures as well as development of the science operations ground system for the Space Telescope will be continued. The Space Telescope Science Institute will progress toward becoming operational through the continued development of the guide star selection system and science data analysis software. In fiscal year 1984, maintenance and refurbishment planning activities such as the purchase of orbital replacement units and space support equipment will be continued to allow for the capability to service the Space Telescope in orbit.

The research and analysis program provides for the research and technology base necessary to define, plan, and support flight projects. Preliminary studies to define missions and/or payload requirements are carried out as are theoretical and ground based supporting research and advanced technology development (ATD). Activities included are supporting research and technology (SR&T), ATD and data analysis.

The suborbital program provides versatile, relatively low cost research tools that complement the capabilities of balloons aircraft, free flying spacecraft and the Space Shuttle in all the space science disciplines, including the study of the Earth's ionosphere and magnetosphere, space plasma physics, stellar astronomy, solar astronomy, and high energy astrophysics. Activities are conducted on both a domestic and international cooperative basis.

Committee comment

Shortly before hearings were held by the Committee on the fiscal year 1984 NASA budget, NASA revealed important management problems and budgetary overruns in the space telescope program.

A subsequent report in March for the House Appropriations Committee identified the deficiencies as: "(1) NASA and contracter gross underestimation of the technical difficulties involved with advanced technology requirements of the Space Telescope program; and (2) NASA's conscious decision to bypass development of prudent engineering test models usually associated with projects of such high-risk technology." The Committee does not disagree with these assessments and is monitoring the corrective management steps initiated by NASA.

Nevertheless, a launch delay of about a year and a project cost overrun of $200 million are likely. The cost overrun figures remain uncertain although impacts are unavoidable in the fiscal year 1983 and 1984 budgets as well as in the out years. While the Committee is concerned about the circumstances that permitted the problems to occur, the first priority is to see the project successfully completed. For that reason, an additional $50 million is authorized to meet the anticipated Space Telescope overrun costs for fiscal year 1984.

This addition is partially offset by deleting $16 million from the Solar Optical telescope (SOT), which is scheduled for launch in late 1989 as a Spacelab payload. The project is currently in the extended definition phase under a contract signed in January 1983 with the facility contractor. The deletion of funds for the SOT does not signify disapproval of the project by the Committee.

The Committee added $5 million for the Space Plasma Laboratory (SPL) which will be flown on a future Spacelab mission. SPL involves investigations of solar/terrestrial relationships, including effects of solar storms on the Earth's environment. The augmentation is intended to minimize the impact on the program from slippage in the mission.

An additional $4 million is also authorized by the Committee, for research and analysis, which directly supports experimental and theoretical research at universities, as well as conceptual and experimental developments that form the basis of new missions. It also represents a high-return, low-cost investment by deriving notable scientific results from the unique data which has been collected from space at a very high public cost.

The Committee authorizes $1 million, in addition to that requested by the administration, for the High Energy Astronomical Observatory (HEAO)-2/Einstein data analysis program. While the HEAO-2 Einstein satellite ceased operations in mid-1981, the 2½ years of X-ray data obtained from this satellite will be the best available for most of the 1980's. For this reason, the Committee believes that the additional funding will achieve continuity in the field of X-ray astronomy.

The Committee has expressed concern in the past about inadequate funding of the space sciences—physics and astronomy, planetary exploration, and life sciences—as the Shuttle development operations commanded a greater and greater share of the NASA

budget. It is the Committee's intention that the balance reflected in the fiscal year 1984 authorization be maintained.

PLANETARY EXPLORATION—$215,400,000

The Committee authorization of $215,400,000 for fiscal year 1984 is $10 million above the administration's request. Further, the addition is entirely for Research and Analysis.

Summary of funding levels, fiscal year 1984

Galileo development	79,500,000
Venus radar mapping mission	29,000,000
International solar polar mission	8,000,000
Mission operations and data analysis	43,400,000
Research and analysis	55,500,000
Total	215,400,000

The planetary exploration program includes the scientific exploration of the planets and their satellites, comets and asteroids, and the interplanetary medium. The program objectives are to understand the origin and evolution of the solar system, to understand better the Earth through comparative studies with the other planets, and to understand how the appearance of life in the solar system is related to the chemical history of the system. The projects undertaken in the past have been highly successful. The strategy that has been adopted calls for a balanced emphasis on the terrestrial like inner planets, the giant gaseous outer planets, and the small bodies (comets and asteroids). Missions to these planetary bodies start at the level of reconnaissance and exploration to achieve the most fundamental characterization of the bodies, and proceed to a level of detailed study. The reconnaissance phase of inner planet exploration began in the 1960's and has now been completed, though we still know little about the nature of the Venus surface. Mars has provided program focus because of its potential as a site of biological activity. The Viking landings in 1976 carried the exploration of this planet forward to a new level of scientific and technological achievement, thereby setting the stage for the next step of detailed study. Analyses of the Moon rock samples returned by Apollo continue to be highly productive as new insights into the early history of the inner solar system are achieved and as our theoretical concepts are revised accordingly. The continuing Pioneer Venus mission is carrying the study of our nearest neighbor, and closest planetary analogue, beyond the reconnaissance stage to the point where we have made a basic characterization of the massive cloud covered atmosphere of Venus. This characterization has also provided some fundamental data about the formation of the planet. The exploration of the giant outer planets began relatively recently with the Pioneer-10 and 11 flybys of Jupiter in 1973 and 1974. These simple reconnaissance spacecraft returned excellent data which contributed much to the later successes of the Voyager-1 and 2 spacecraft. Voyager-1 encountered Jupiter in March 1979 and Saturn in November 1980. Voyager-2 flew by Jupiter in July 1979, and then Saturn in August 1981. Our scientific knowledge of this part of the solar system has increased greatly in less than a decade. New data on the planets, satellites, and rings have revolutionized our concepts of the formation and

evolution of the solar system. Now, the Pioneer-10 and 11 and Voyager-1 spacecraft are on escape trajectories from the solar system as they continue to monitor their uncharted environments. The Voyager-2 spacecraft is headed for an encounter with Uranus in 1986.

The Galileo mission, a cooperative effort between the United States and the Federal Republic of Germany, will be launched to Jupiter in 1986 by the Space Shuttle/Centaur upper stage. The payload is expected to extend our knowledge of Jupiter and its system of satellites beyond the profound discoveries of the Voyager and Pioneer missions. During 20 months of operation in the Jovian system, Galileo will have the capability to provide six satellite encounters, and an instrumented probe will be injected into Jupiter's atmosphere to a depth where the pressure is equivalent to 10 times the pressure exerted by the Earth's atmosphere.

The Venus radar mapper (VRM) mission, which will be initiated in fiscal year 1984, will focus on the cloud shrouded surface of Venus. The VRM, using a synthetic aperture radar, will obtain global radar imagery of Venus with resolution sufficient to address fundamental questions regarding the origin and evolution of the planet, and will obtain altimetric and gravity data to determine accurately the gravity field, internal stresses, and density variations of the planet's interior. This data will be analyzed so that the evolutionary history of Venus can be compared with the Earth's. The VRM, scheduled for launch in 1988, will map essentially the entire planet in 243 days.

During fiscal year 1983, extensive definition and preparation activities will be conducted on the VRM mission definition and planning as part of the planetary exploration advanced programs activities.

The current planning estimate for the VRM mission is in the $350 million range. This includes development through launch plus 30 days in-flight checkout, support during the 243-day mapping period, and analysis of the scientific data. The estimate for space transportation support is approximately $155 to 165 million.

The international solar polar mission (ISPM) is a joint NASA and European Space Agency endeavor that will fly a package of experiments outside the solar ecliptic plane. The ISPM, which will provide data on the effects of solar activity on the Earth, will be launched in 1986 on the Shuttle/Centaur upper stage.

The international solar polar mission (ISPM) is a joint NASA and European Space Agency (ESA) program wherein ESA will provide the spacecraft and some instrumentation and NASA will provide the remainder of the instrumentation, investigator support, launch services, tracking, and radioactive thermal power generations. The mission is designed to obtain the first view of the solar system from outside the plane in which the planets orbit the Sun's equator. The mission will aid in the study of the relationship between the Sun and its magnetic field and particle emissions (solar wind and cosmic rays) as a function of solar latitude, thereby providing an insight into the effects of solar activity on the Earth's weather and climate. The ISPM will be launched in 1986 on the Shuttle/Centaur.

The ISPM was restructured in fiscal year 1981, from a two-spacecraft mission—one provided by the United States and one provided by ESA—to a single ESA spacecraft mission; however, the U.S. participation in the program remains substantial. NASA is developing five of the nine principal investigator instruments and three of the four European investigations have U.S. coinvestigators.

During fiscal year 1983, the U.S. flight instruments will be delivered to the ESA spacecraft developer for integration and system testing. After the ISPM spacecraft system testing has been completed, the instruments will be calibrated before being stored in 1984 until launch. During fiscal year 1983, the mission operations planning activities will be continued.

The mission operations and data analysis program funds the operation phase of planetary missions after development, launch, and initial inflight check out is complete. It also provides for multimission flight support. Currently active planetary missions being supported within mission operations and data analysis are Voyagers 1 and 2, Pioneer-Venus, and Pioneer 6–11. The Voyager–1 post-Saturn encounter mission operations and the Voyager–2 cruise to Uranus will be continued.

Since their launches in 1977, the two Voyager spacecraft have encountered both the Jupiter and Saturn systems and achieve all of their original objectives. Voyager–1 is now on a cruise trajectory which will take it out of the solar system at a steep angle to the plane of the eclipse. The spacecraft will collect data on the space environment as it proceeds to the outer limits of our solar system. Voyager–2 successfully flew near Saturn in August 1981 and was placed on a trajectory which will take it to an encounter with the planet Uranus in January 1986.

Operation of the Pioneer Venus and the Pioneer 6–11 spacecraft is continuing. The Pioneer Venus orbiter continues to collect data on the planet Venus which is scientifically important and is very significant in preparing for the Venus radar mapper mission. The pioneer 6–9 spacecraft are operating in interplanetary space in solar orbit, and data is being acquired from the spacecraft when unusual solar phenomena occur or as unique scientific opportunities arise. The Pioneer 10 and 11 spacecraft are on a course that will take them out of the solar system in opposite directions.

The research and analysis program contains five elements required to assure that data and samples returned from flight missions are fully exploited; undertaking complementary laboratory and theoretical efforts; defining science rationale and development of required technology to undertake future planetary missions; coordinating an international Halley's Comet watch, providing coinvestigator support to the European Space Agency's Giotto mission to Halley's Comet; and for a proportional share and occupancy of the mid-level facility for visiting astronomers at the infrared telescope facilities on Mauna Kea, Hawaii.

Committee comment

The Committee has strongly supported planetary exploration in the past. Previously, the costs of missions were increasing rapidly beyond what could reasonably be funded. This year's proposed budget gives hopeful indication that a steady, ambitious planetary

exploration program is achievable within practical budgetary limitations.

The Committee recognizes and applauds the role and imagination which has been played by the Solar System Exploration Committee (SSEC). The SSEC has just published its recommendations for a core program of low and moderate cost planetary missions to be flown through the remainder of this century. Of the missions proposed by the SSEC. The Venus radar mapper is included in the authorization as a new start for fiscal year 1984.

An additional $10 million is authorized for research and analysis. The reasons for adding to this category are similar to those provided in the Committee comments for physics and astronomy.

The Committee continues to support the infrared telescope facility and expects that NASA will fund its operation unless and until the National Science Foundation provides the support.

LIFE SCIENCES—$59,000,000

The Committee has authorized $59.0 million for fiscal year 1984 as follows:

Summary of funding levels, fiscal year 1984

Life sciences flight experiments	$23,000,000
Research and analysis	36,000,000
Total	59,000,000

The goals of the life sciences program are to provide a sound scientific, medical, and technical basis for safe and effective manned space flight and to understand the basic mechanisms of biological processes using the unique capabilities of the space program. Results from the research program are applied to immediate needs in the maintenance and health of the astronauts; to the design of future support systems for the astronauts; to understanding the response of biological systems to weightlessness; to the design of controlled life support systems for use in future missions; and to the understanding of the larger scale system—the biosphere of the planet Earth. In the longer term, this program is the key to developing a capability to sustain a permanent manned presence in space. The program includes both ground-based and space research which are mutually supportive and integrated. The program uses a composite of disciplines and techniques in both biology and medicine to address space-related medical problems and fundamental biological processes.

The life sciences flight experiments project is directed toward understanding the basic mechanisms and time histories of biological and medical processes as they occur in zero gravity. The project includes the whole process of experimental design, development, in-flight execution, data analysis and reporting.

Current activities include the development and fabrication of life sciences flights experiments for early Shuttle flights (e.g., Spacelab–1, Spacelab–2, Spacelab–3 and Spacelab–4). Spacelab–4 is the first flight dedicated entirely to life sciences investigations.

The research and analysis activity of the life sciences program supports ground-based research in biological and biomedical problem areas that have been identified in previous flights or have

been determined to be highly probable in future flights. The program is composed of five elements: (1) operational medicine, (2) biomedical research, (3) space biology, (4) terrestrial biology, (5) life support systems research. The operational medicine element is the catalyst responsible for bringing the science, technology, and practice of medicine to bear on sustaining, supporting and protecting the individual working in the space environment. Biomedical research develops the basic medical knowledge needed to enable men and women to operate more effectively in space. It is organized into discreet elements with each designed primarily to rectify a particular physiological problem expected to affect the human organism in prolonged or repetitive spaceflight. Space biology explores the role of gravity in life processes and uses gravity as an environmental tool to investigate fundamental biological questions; for example, investigation and identification of the role of gravity in plant and cellular animal processes or embryonic development. Terrestrial biology includes the study of the origin, evolution, and distribution of life and life-related molecules on Earth and beyond. Sophisticated analyses of life as we know it afford a unique opportunity to address a most fundamental question regarding the origin of life on Earth and the existence of such processes elsewhere. Life support systems will focus on the continuing research and development efforts needed to increase and enhance our ability to support long duration manned space occupancy and maximize astronaut and passenger-scientist productivity.

Committee comment

The life sciences program continues to be vitally important, in the view of the Committee, particularly if prolonged manned presence and activity in space is to be achieved. The successful first Shuttle extravehicular activity (EVA), accomplished on STS–6, was an additional step toward that end.

There continue to be important questions about man's adaptation to weightlessness, particularly regarding certain health effects. The 14 percent increase above the fiscal year 1983 budget for research and analysis is primarily in recognition of the importance of understanding and solving this problem.

SPACE APPLICATIONS—$321,000,000

The objective of the space applications program is to conduct research and development activities that demonstrate space-related technology, systems, and other capabilities which provide down-to-Earth practical benefits. These activities are grouped in the following general areas: resource observations, environmental observations, applications systems, technology transfer, materials processing in space, communications and information systems. In each of these areas, programs are being planned and conducted to contribute to the solution of pressing national, as well as international, problems and needs. The funding levels for these activities are shown in the following tables:

Summary of Funding Levels, Fiscal Year 1984

Solid earth observations	$86,400,000
Environmental observations	173,000,000

Materials processing in space	26,600,000
Communications	26,100,000
Information systems	8,900,000
Total	321,000,000

Committee comment

The Committee attaches a great deal of importance to the overall space applications program. To insure that the Nation is investing sufficiently and wisely in this area, the Committee believes a long-term strategy and plan for the applications program is warranted, comparable to the excellent effort conducted by the Solar System Exploration Committee for the planetary exploration program. The Committee requests NASA to undertake such an effort covering all activities within the applications program. The Space Applications Board of the National Research Council might be able to assist in such an effort.

The Committee has taken the first step in augmenting various space applications activities: solid Earth observations ($12 million); environment observations ($10 million); materials processing in space ($5 million); and communications ($5 million).

Solid Earth observations—$86,400,000

The Committee authorization of $86,400,000 provides $12 million more than the administration request. This increase is for AgRISTARS ($3 million) and research and analysis ($9 million).

Summary of funding levels, fiscal year 1984

Landsat-4	$15,800,000
Extended mission operations	1,000,000
Shuttle/Spacelab payloads	15,000,000
Geodynamics	28,000,000
AgRISTARS	3,000,000
Research and analysis	23,600,000
Total	$86,400,000

The broad objectives of the solid Earth observations program are to develop and apply space observation techniques to meet national and global needs for improved management of food, fiber, water and land resources; improve our ability to systematically evaluate the composition and geometry of the Earth's crust in order to increase the effectiveness of global assessment, exploration, and development of mineral and energy resources; and increase our understanding of the solid Earth, its interior structure and composition, its rotational dynamics, the processes related to the movement and deformation of its crust, and the mechanisms associated with the occurrence of earthquakes. Principal elements of the program include the development of space and supporting ground systems and improved data processing and analysis techniques; Shuttel and aircraft support for sensor and technique development; as well as basic and applied research for identifying, monitoring, analyzing, and modeling the vegetated and geological features of the Earth.

Landsat-4, with its multispectral scanner (MSS) and thematic mapper (TM) sensors, was launched in July 1982 and has relayed excellent images obtained from the multispectral scanner. For sev-

eral months, the thematic mapper was also relaying superb images. However, in February 1983, the X-band transmitter that sent data directly to the ground from the TM failed. Landsat officials believe that transmission will resume when the tracking and data relay satellite system (TDRSS) becomes operational.

In addition to this deficiency, only intermittent operation of two of the four power cables has been possible since April 1983. If the malfunctioning cables are not corrected, TM transmission could be severely limited.

In January 1983, NOAA assumed operational responsibility of Landsat-4 and the MSS instrument while NASA will continue to operate and conduct research with the TM until 1985. Assembly of the Landsat-4 backup, Landsat-D′, is soon to be completed and then Landsat-D′ will be turned over to NOAA for storage.

The purpose of the new TM sensor, which has improved spectral and spatial resolution, is to expand the use of data gathered from space for agricultural, oil and gas, minerals, water resources, land use, and other applications. Other aspects of the solid Earth observation program are the research associated with understanding the physical relationship of various types of vegetation and other surface features with the radiation which they emit or reflect; the development of models appropriate to the management of resources; and the evaluation of the use of space-derived data along with other data sources in meeting user needs. The scope of these activities ranges from individual scientific studies to projects such as the agriculture and resources inventory surveys through aerospace remote sensing (AgRISTARS).

AgRISTARS, a research, development and test program, addresses identified U.S. Department of Agriculture information requirements by combining NASA's unique remote sensing development expertise with complementary resources from the Departments of Agriculture and Commerce. This program has become the focal point of remote sensing research for application to global vegetation assessments, both within the involved Federal agencies and by the scientific community in general.

Studies of the movement and deformation of the Earth's crust, the rotational dynamics of the Earth, and the Earth's gravity and magnetic fields provide information which is needed to: Understand the processes leading to the release of crustal strain in the form of earthquakes; improve our understanding of the formation of mineral deposits; contribute to better understanding of the Earth as a planet. Space techniques such as laser ranging to satellites and the Moon, and very long baseline interferometry using radio stars or satellites, are the only methods which can provide the precise measurements needed for these studies.

The objective of the Shuttle/Spacelab payload development project is to develop, test, and evaluate Earth-viewing remote sensing instruments and systems to obtain data for solid Earth observations research. Both the Shuttle imaging radar, which was flown on the Shuttle orbital test flight in November, 1981, to evaluate the utility of spaceborne imaging radar for geologic exploration, and the Shuttle multispectral infrared radiometer, which was used to determine the optimum spectral bands for surface materials classification, operated successfully. The large format camera, required

for high resolution mapping applications, is being prepared for launch on the Shuttle in 1984. The next generation Shuttle imaging radar is under development leading to a 1984 Shuttle launch.

The focus of the multispectral linear array (MLA) advanced technology development is on the development of technology for a future high performance MLA instrument which can be used as a diagnostic tool for remote sensing. The MLA solid-state sensor has a number of significant features such as electronic scan, inherent geometric and spectral registration, and programmable high spatial and spectral resolution. The imaging spectrometer is being continued in fiscal year 1983.

Committee comment

The Committee believes that the space applications programs have generally been underemphasized in the administration's fiscal year 1984 request. This is of special concern since it is this research and development from which future space applications for defense and commerce, as well as science, will emerge. Further, this is an area in which we are being increasingly challenged by other nations. Even where a private sector role develops for operation of space applications, there will likely remain a necessary and desirable governmental role for research and development, particularly where the lead time to commercial application is too long and too costly and the level of effort is too risky for private sector entities to justify the endeavor.

The administration's proposed NASA budget contains little funding for continued sensor development for land remote sensing. In early March, the President announced his decision to pursue the transfer of the weather and land remote sensing satellites to the private sector.

The Committee is concerned that neither the operational capability nor continued R&D of land remote sensors is assured and that each could well be lost to aggressive foreign competition—a loss of a commercial opportunity which would have been pioneered by the United States at great public expense. The operational design life for the Landsat system is 1988, but it could cease earlier. The Committee requests NASA to undertake a study to determine the technical and cost implications of a Landsat retrieval and repair mission compared to the procurement of a follow-on satellite.

At the same time, there is private sector interest in operational responsibility for land remote sensing and the Committee intends that this interest be seriously and responsibly considered. Title II of S. 1096 provides that any transfer of the Earth or weather remote sensing satellite systems first be reviewed and approved by the appropriate authorizing committees and the Congress. This provision is intended to preserve the legitimate role of the Congress in assuring that any transfer is responsible, equitable and protects the public interest. It does not preclude or prejudge such a transfer.

Regardless of the rationale of the decision to transfer the satellite systems, the Committee believes that NASA retains a role for related R&D. Therefore, the Committee has authorized additional funds for R&D which supports future remote sensor development and utilization data. Thus, additional funds are authorized for:

AgRISTARS ($3 million); research and analysis ($5 million); and technology transfer ($4 million).

Environmental observations—$173,000,000

This Committee's authorization of $173 million includes an increase of $10 million above the administration's request, to be allocated as follows: space physics/advanced technological development, ($2 million); upper atomosphere research satellite—experiments, ($4 million); atmospheric dynamics and radiation research and analysis, ($2 million); and oceanic processes research and analysis, ($2 million).

Summary of funding levels, fiscal year 1984

Upper atmosphere research and analysis	$29,600,000
Atmospheric dynamics and radiation research and analysis	30,400,000
Oceanic processes research and analysis	20,200,000
Space physics/ATD research and analysis	17,700,000
Shuttle/Spacelab payload development	7,600,000
Operational satellite improvement program	600,000
Earth radiation budget experiment	15,500,000
Extended mission operations	27,400,000
Upper atmosphere research satellite experiments and mission definition	24,000,000
Total	173,000,000

NASA's environmental observations program has the goals of improving the understanding of processes in the atmosphere and the oceans, providing space observations of parameters involved in these processes and extending the national capabilities to predict environmental phenomena and their interaction with human activities. Because many of these phenomena are global or regional, they can be most effectively, and sometimes solely, studies from space. NASA's program includes scientific research efforts plus the development of new technology for global and synoptic measurements. NASA's research satellites provide a unique view of the radiative, chemical, and dynamic processes occurring in the atmosphere and oceans.

To achieve these goals, a number of significant objectives have been established for the next decade. These include advancing the understanding of the upper atmosphere through the determination of the spatial and temporal distribution of ozone and select nitrogen, hydrogen, and chlorine species in the upper atmosphere and their sources in the lower atmosphere; optimization of the use of space-derived measurements in understanding large scale weather patterns; advances in our knowledge of severe storms and forecasting capabilities; ocean productivity and air-sea interactions; and an improved knowledge of seasonal climate variability leading to a long-term strategy for climate observation and prediction and a comprehensive understanding of the solar terrestrial connection and detailed determination of the physics and coupling between the solar wind, magnetosphere, and ionosphere.

The upper atmospheric research satellite experiments (UARSE) activity, initiated in fiscal year 1982, will provide a set of satellite instruments capable of making a comprehensive measurement of the state of the stratosphere. Detailed definition studies of 16 in-

struments have been completed and a final determination has been made to proceed with development of 9 of these instruments.

The Earth radiation budget experiment (ERBE) mission is proceeding on schedule toward a 1984 launch date. NASA has continued to support the National Oceanic and Atmospheric Administration (NOAA) by managing the development of the NOAA and the geostationary operational environmental satellites (GOES) series on a reimbursable basis. NOAA–C and GOES–E were launched in 1981 and, NOAA–E and GOES–F have been launched in 1983. NOAA–F is scheduled for a 1984 launch.

Effective utilization of remote sensing requires a balanced set of activities including: analytical modeling and simulation, laboratory research of fundamental processes, development of instrumentation, flight of the instruments on the Space Shuttle and dedicated spacecraft, collection of in situ ancillary or validation data, and scientific analysis of data. The approach is to develop a technological capability and a strong scientific base and then to collect appropriate data (from space and in situ) which, taken together, will address a particular program objective.

Studies of the upper atmosphere have led to a new assessment of the impact of chlorofluorcarbons on stratospheric ozone which was reported to the Congress in January 1982. The revised assessment of the predicted impact is somewhat less severe; this assessment is the result of improved measurements in our continuing program of laboratory chemical kinetics measurements.

Three-dimensional models of the stratosphere are being developed to quantify our understanding of the interrelation of chemistry with dynamics and radiation. The record of satellite ozone measurements now extends for over a decade and is being used in studies to determine if there have been long term trends in the average amount of global ozone which shields the Earth's surface from harmful ultraviolet radiation.

The ability to perform temperature and moisture soundings of the atmosphere from geostationary orbit has been demonstrated by the flight of the NASA-developed visible/infrared spin-scan radiometer and atmospheric sounder instrument on GOES–4 and NOAA–5 spacecraft. The opportunity afforded by geostationary orbits to observe a localized region continuously will permit intensive study of the evolving temperature and moisture environment of severe local storms. Low Earth orbit sounding capabilities are now enabling the extension of forecast reliability from 3 to 5 days. In certain situations, reliable forecasts of a 8 to 10 days duration have been achieved.

The research and analysis activities within the atmospheric dynamics and radiation program comprise a core effort which is fundamental to using space technology to solve problems in atmospheric science. The program includes global weather, severe storms and local weather and climate research. These research activities involve large-scale atmospheric processes, general circulation, atmospheric-surface interactions, mesoscale processes including severe weather phenomena, and radiation balance studies in order to further man's understanding of the atmosphere on all temporal and spatial scales and to study the capability for measuring these processes from space.

The goal of the oceanic processes program is to develop and apply spaceborne techniques to advance our understanding of the fundamental behavior of the oceans. The primary objectives are to: process data from past and existing spacecraft (Seasat and Nimbus-7); to make these data available to the community in usable and workable form; assess the performance of sensors to obtain useful geophysical information; and use this information for scientific analysis. All Seasat data have been archieved at NOAA in a centralized data storage facility, and interactive computer terminals have been installed at five oceanographic research centers. Procedures have been implemented to allow routine processing of Nimbus-7 data without any backlogs.

Committee comment

The Committee's $10 million increase above the administration's request includes $2 million for the space physics/advanced technological development program. This increase is specifically for university research teams conducting experiments on the origin of plasmas in the Earth's neighborhood (OPEN). OPEN is a major initiative in the study of the Sun-Earth relationship, specifically the flow of charged particles through the Earth's space environment above the upper atmosphere. The Committee believes that the reductions proposed for OPEN by the administration would result in disbanding enough of the team capability which has been built to compromise excessively the achievement of the program goals.

While the upper atmosphere research satellite (UARS) mission has been delayed as a new start for fiscal year 1984, the experiments development is progressing. The additional funds for UARS ($4 million) will sustain the UARS experiments development capabilities.

The Committee's recommendation for increased funding for atmospheric dynamics and radiation research and analysis and for oceanic processes research and analysis is based on a concern that, NASA has been relinquishing its atmospheric and ocean remote sensing R&D efforts which it traditionally has pursued. NASA should make a stronger effort to advance its remote sensing technologies and capabilities in these areas and therefore the Committee has added $2 million for atmospheric R&D (for an advanced microwave sounder) and $2 million for oceanic R&D (for an advanced scatterometer).

Materials processing in space—$26,600,000

The Committee has authorized $26,600,000 for materials processing in space in fiscal year 1984, compared to the administration request of $21,600,000.

The materials processing in space program emphasizes the fundamental science and technology of processing materials in space. This will lead to an understanding of the constraints imposed by Earth's gravitational forces and the unique capabilities made possible by controlling these processes in the space environment. Ground-based research, technology development, and payload definition activities concentrate on three major processing areas: Crystal growth and solidification, containerless processing, and fluid and chemical processing. Limited research is supported in the

areas of cloud physics, combustion science, vacuum science, and fluid dynamics. These activities provide the scientific basis for future space applications of materials processing technology. Definition study activities are performed for Shuttle payload candidates such as the acoustic containerless experiments system, the combustion science system, and the containerless measurement system.

Materials experiment operations is a consolidation of ongoing activities which provide a range of experimental capabilities for all scientific and commercial participants in the materials processing in space program. These include drop towers and aircraft and sounding rocket flights as well as the Shuttle mid-deck experiments and the material experiment assembly. These capabilities will enable users to develop experiments in a cost-effective manner and allow NASA to develop a better understanding of the technical risks associated with experiment concepts before attempting to develop more complex hardware. In addition, limited reflight of currently selected investigations on sounding rockets and on Shuttle/Spacelab missions is included in materials experiment operations.

Committee comment

The limited understanding of materials processing in space and the applicable commercial applications places materials processing in space on a long-term, high-risk, high-cost, category that is generally beyond the capacity of most private commercial concerns. Further, the Committee recognizes that, until the technical capability and economic feasibility of new space processing techniques have been demonstrated, major financial commitments from the private sector will be slow in coming.

The need for additional funding in materials processing is pointed out by the termination in March, 1983, of a joint endeavor agreement (JEA) between GTI Corp. and NASA. The JEA covered a materials processing alloy furnace scheduled to fly aboard the Shuttle in 1984. However, GTI's inability to identify sufficient customer market to support a viable commercial enterprise, GTI withdrew from the JEA.

The promise of materials processing in space remains high. The Committee authorizes an additional $5 million above the administration request to continue the development of the technology and capabilities for potential users of materials processing in space. The Committee urges that NASA apply part of this increase to developing small-scale hardware for preliminary flight experiments and for validation or proof of concept. Further, part of the augmentation should be used for processes involving the separation and purification of biomaterials.

Communications—$26,100,000

The Committee authorizes an additional $5 million to the administration's request of $21,100,000 for fiscal year 1984.

The communications program provides the technology that allows the most effective use of the geosynchronous orbit and radio frequency spectrum. A major portion of the program resources is currently concentrated in the applied research and data analysis element of the program which is focused on new communications

subsystem technology. In fiscal year 1983, multiyear contracts are being continued with industry to develop a technology base in advanced communications for the 1990's. These initial efforts, which will be completed in fiscal year 1984, will produce laboratory models of multibeam antennas, onboard switching, signal processing, and radio frequency components.

The search and rescue program uses satellites to aid in the detection and location of distress beacons carried by aircraft and ships. The demonstration and evaluation phase began in 1982 with the launch of the Soviet satellite, COSPAS 1. The search and rescue antennas, receivers, signal processor and transmitter for the NOAA-E spacecraft have been integrated and tested, completing all necessary preparations for launch of NOAA-E in 1983. In fiscal year 1982, the ground station development was also completed. Three ground stations were installed at search and rescue facilities operated by the U.S. Coast Guard and the U.S. Air Force.

Experimental distress transmitters operating at 406 MHz have been completed and deployed in accordance with the demonstration and evaluation plan. This work has been done in cooperation with Canada, France, and the Soviet Union. Payloads will be flown on six meteorological spacecraft operated by the National Oceanic and Atmospheric Administration, and at least two Soviet COSPAS spacecraft. The advanced communications technology satellite (ACTS) technology development process is being continued in fiscal year 1984 to develop a 30/20 GHz satellite. In March, 1983, NASA issued a notice of intent for experiments for ACTS, which is scheduled for a 1988 launch.

Committee comment

The Committee strongly supports NASA's ACTS effort and believes additional communications R&D efforts are justified. The Committee recommends that the additional $5 million be applied to areas other than the ACTS program for research and systems studies of potentially feasible advanced communications systems for new services, such as video-conferencing, two-way computer transactions, and mobile communications. Also, NASA should emphasize high-risk research and development related to ground terminals and to intersatellite links.

Information Systems—$8,900,000

The Committee authorization for fiscal year 1984 is $8,900,000 identical to the administration request.

The objectives of the information systems programs are to: Develop and demonstrate advanced capabilities for managing, distributing, and processing data and information; implement information systems standards and provide transportable common software in order to lower data systems costs; and develop the basis for data services to provide improved access to, and rapid delivery of, space data and advanced data systems in support of the Nation's satellite programs and the space science and applications projects.

This program provides for timely development of data systems capabilities to meet the needs of flight missions and major space science and applications programs. The early demonstration of ca-

pabilities has a high potential for reducing ground data systems development risks and the chance of late data delivery.

TECHNOLOGY UTILIZATION—$10,000,000

The Committee authorizes for fiscal year 1984 $10 million for technology utilization, $6 million above the administration's request.

The NASA technology utilization program is designed to enhance national economic growth and productivity through the transfer of new technology resulting from NASA research and development programs to the nonaerospace sectors of the economy. In addition to generating use of aerospace technology in U.S. industry, such technological advances have found use in important public sector areas such as medicine, transportation, environment and public safety. The specific objectives of the program are to accelerate and facilitate the application and use of new technology thus shortening the time between development of advanced aeronautics and space technologies and their full use in the economy; to encourage multiple secondary uses of NASA technology in industry, education, and Government where a wide spectrum of technological problems and needs exists; to understand more fully the technology transfer process and its impact on the economy, and to manage and optimize the process in a systematic way; and to develop applications of NASA's aerospace expertise—its technology, technologists and unique facilities—to nonaerospace needs of the Nation.

Since the program's inception in 1962, a multifaceted array of transfer mechanisms has evolved—mechanisms designed to facilitate the use of aerospace technology in the public and private sectors of the economy. These mechanisms include: publications and announcements, and industrial conferences. In fiscal year 1984, NASA proposes to build on its technology transfer activities to strengthen expanded Government-industry cooperation.

Committee comment

The NASA technology utilization program is a long standing effort to increase nonaerospace, commercial utilization of NASA-developed technology. Studies indicate that the demonstrated economic benefits are six times the cost of the technology utilization program.

The Committee remains concerned about an apparent disregard of congressional intent in the proposed funding request of $4 million. In fiscal year 1983, the budget request was for $4 million, but this Committee added $5 million.

The intent of this Committee's $6 million augmentation is to ensure that NASA will continue the development and implementation of a technology utilization function that actively applies to the full range of the agency's institutional expertise to nonaerospace technology problems of the industrial and public sectors.

AERONAUTICAL RESEARCH AND TECHNOLOGY—$328,300,000

The Committee authorizes $328,300,000 for fiscal year 1984, $28 million above the administration request, to be allocated as follows:

Research and technology base	$212,800,000
Systems technology programs	115,500,000
Total	328,300,000

The administration request of $300,300,000 is $20,300,000 greater than the fiscal year 1983 operating level. This increase is comprised primarily of the $20 million new start for the numerical aerodynamic simulator, a program that this Committee supports. The administration request provides no real growth in aeronautical research and technology. In fact, the administration request for $72,500,000 for systems technology programs for fiscal year 1984 is 12 percent below the level of $82,300,000 provided by Congress for fiscal year 1983.

Consistent with its position in fiscal year 1983, the Committee desires that systems technology programs be funded at a level $43 million above the level of the administration request of $72,500,000. This funding can be achieved by an augmentation of $28 million provided in this authorization and by agency reprogramming of $15 million from the research and technology base for support of systems technology programs.

The Committee's purpose is to allocate $32 million among the following systems technology programs:

Advanced turboprop	$18.0
Laminar flow control	5.0
Advanced transport operating systems	2.0
Advanced turbofan	4.0
General aviation/commuter engine technology	3.0

and $11 million, to be allocated at the discretion of the agency to the following systems technology programs: Advanced metallics/structures; advanced composites; energy efficient engine; energy efficient transport; and aeronautical systems studies.

The Committee calls particular attention to its desire that the above funding for the advanced turboprop shall include preparations for a flight research and test program by 1987. This should be on an accelerated basis to provide technology validation for this propulsion concept adequate to enable the private sector to undertake the financial risk of aircraft and power plant development based on this technology.

The objectives of the aeronautics program are to advance aeronautical technology to insure safer, more economical, efficient, and environmentally acceptable air transportation systems which are responsive to current and projected national needs; to support the Department of Defense in maintaining the superiority of the Nation's military aircraft; and to maintain the strong competitive position of the United States in the international aviation marketplace.

The research and technology base program will build on the substantial results of the ongoing program, utilizing the unique NASA experimental facilities, research aircraft, computer capabilities, and expertise now in existence. Fundamental discipline efforts will continue to lead to significant advances in a number of areas: nonintrusive experimental test techniques and the development of computational methods to better understand and predict aerodynamic and thermodynamic characteristics associated with complex flows over aircraft and in propulsion systems to improve perform-

ance and reduce development costs; metallic, ceramic, polymer, and composite materials for high temperature engine applications and lightweight airframe structures; the development of analytical methods to improve life prediction and better understand and control the dynamic response of complex aircraft and engine structures; electronics and highly reliable, fault-tolerant aircraft control system software and architectural concepts; crew station technology and the capability of modeling pilot behavior in a multivariable environment; and a better fundamental understanding of alternative fuels and their potential impact on engine performance. The discipline and vehicle oriented research and technology base efforts in the various speed regimes will continue with wind-tunnel investigations on advanced aircraft and rotorcraft configurations, and examinations of the effects of promising technology advances individually and in combination.

The systems technology programs are designed to accomplish the following objective: To extend the scientific discoveries and findings flowing from the research and technology base through applied research to demonstration and validation for selective technologies which thereafter provide the design base for advanced military and commercial products undertaken by private industry.

The NASA request for systems technology programs would continue work in rotocraft systems technology, high performance systems technology, and the advanced composites technology program. This NASA request would also initiate the numerical aerodynamic simulator (NAS), which is designed to augment our capabilities in computational fluid dynamics and other areas of computational physics.

However, the NASA request deemphasizes certain systems technology programs, authorized by this Committee and Congress in the past, that provide significant technology validation activities with civil application. The intent of the Committee is to restore funding to those programs to continue the proof-of-concept work needed to maintain a superior U.S. aviation industry.

Committee comment

The Committee is greatly concerned over this fourth consecutive decline in yearly shipments of civil aviation products (now at its lowest level since 1972) coinciding with pronounced growth in the foreign competitors' share of the world market for aircraft, engines, and related aviation products. Development and adoption of superior aeronautical technology for and by the U.S. aviation industry provides the soundest prospect for preserving U.S. industry's worldwide technological and market leadership. Failure in this objective invites the specter of economic and employment distress which has characterized the U.S. steel industry, its maritime industry, its textile industry, and most recently its automobile industry.

This Committee, and indeed both Houses of Congress, know that development of systems technology programs, long a major role of NASA, provide the technological edge which assures the competitive advantage needed to maintain the industry's strong position in world markets. This role of the agency has been amply reaffirmed by two independent studies completed in 1982. These are the Na-

tional Research Council's study on aeronautics research and technology requested by the Senate Appropriations Committee and published in July, and the Office of Science and Technology Policy-directed study on aeronautical research and technology policy published in November.

The Committee is, therefore, distressed at the administration's second consecutive NASA budget request in which it has ignored the concern of Congress and sought to curtail sharply those systems technology programs which were oriented toward such civil aviation development. For fiscal year 1983 the administration proposed to reduce that category of programs by $42 million. Congress restored $48 million. For fiscal year 1984 the administration again proposes to reduce that category by $10 million from the level provided by Congress for fiscal year 1983. In the authorization, the Committee restores $28 million, confident that the Congress will again recognize the urgency of a strong aeronautics systems technology program to preserve the competitive leadership of our civil aviation industry and the contributions of that leadership to our foreign trade balance, to domestic employment, and the quality and safety of aviation services for people throughout our Nation and the free world.

SPACE RESEARCH AND TECHNOLOGY—$138,000,000

The Committee authorizes $138 million for space research and technology, as requested by the administration.

Summary of funding levels, fiscal year 1984

Research and technology base	$126,200,000
Systems technology programs	7,200,000
Standards and practices	4,600,000
Total	138,000,000

The overall objective of the space research and technology program is to advance the technology base in support of NASA's role as an effective, productive, and long-term contributor to the continued preeminence of the nation in space. A timely investment in research and technology is essential to support and promote rapidly expanding civil, military, and commercial space interests. In planning the space technology program, the Office of Aeronautics and Space Technology (OAST) consults extensively with other NASA program offices, the Department of Defense, and industry in order to identify and anticipate technology needs. Systems analyses and trade-off studies are also conducted to identify high payoff technologies that will enable future space missions. Research and technology development evolves from concept to laboratory, then to proof-of-concept testing on ground or in space and eventually to program application, in a long-term process of incremental progress along both planned and unexpected opportunity paths.

The space research and technology program is committed to: (1) providing a base of proven technology supporting future national programs in the conception and design of advanced spacecraft; (2) continuing development of the technology foundation for improving low-cost access to space through Shuttle enhancements and orbital transfer concepts; (3) supporting activities related to a more perma-

nent human presence in space by focusing technology; (4) supporting the projected long-term needs of military and commercial use of space.

Committee comment

The Committee recognizes that a strong space research and technology base is vital to maintain our Nation's leadership in space and to pursue an aggressive space program. With increasing competition from foreign nations in areas of advanced satellite communications, remote sensing technologies, materials processing, and scientific research, adequate levels for this space systems technology base become even more critical in providing options for both the commercial and Government sectors to meet this competition.

TRACKING AND DATA ACQUISITION—$700,200,000

The Committee authorizes the budget of $700,200,000 for Tracking and Data Acquisition as requested.

Summary of funding levels, fiscal year 1984

Space network	$294,700,000
Ground network	231,500,000
Communications and data systems	159,800,000
Advanced systems	14,200,000
Total	700,200,000

The purpose of the program is to provide vital tracking, command, telemetry, and data acquisition support to meet the requirements of all NASA flight projects. In addition to NASA flight projects, support is provided for projects of the Department of Defense, and on a reimbursable basis to other Government agencies, commercial firms, and other countries and international organizations engaged in space research endeavors.

Support is provided for sounding rockets, research aircraft, Earth orbital and suborbital missions, planetary spacecraft, and deep space probes. The program also includes the support of all phases of the Space Shuttle flight program. The various types of support provided include: (a) tracking to determine the position and trajectory of vehicles in space; (b) acquisition of scientific and space applications data from on-board experiments and sensors; (c) acquisition of engineering data on the performance of spacecraft and launch vehicle systems; (d) transmission of commands from ground stations to spacecraft; (e) communication with astronauts; (f) transfer of information between the various ground facilities and central control centers; (g) processing of data acquired from the launch vehicles and spacecraft; and (h) reception of television transmission from space vehicles. Such support is essential for achieving the scientific objectives of all flight missions, for executing the critical decisions which must be made to assure the success of these flight missions, and, in the case of Shuttle missions, to insure safety of the crew.

Tracking and acquisition of data for the spaceflight projects is accomplished through the use of a worldwide network of NASA ground stations. When the tracking and data relay satellite system becomes operational, tracking support will be provided by a system

of tracking and data relay satellites in geosynchronous orbit. Ground facilities are interconnected by ground communications lines, undersea cables, and communications satellite circuits which are leased from communications carriers, both domestic and foreign. This interconnection provides the communications capability needed between spacecraft and the control centers from which the flights are directed.

The space network consists of the tracking and data relay satellite system (TDRSS) and a number of NASA ground elements to provide the necessary tracking, telemetry, command, and communication services to low Earth-orbital spacecraft. The TDRSS itself consists of a three-satellite spacecraft system in geosynchronous orbit and a single ground terminal located at White Sands, N. Mex. The satellites communicate with the user spacecraft in space and relay information to and from the ground terminal. From the ground terminal, satellite and ground communication links interconnect the NASA elements of the network and any remotely located user facilities.

The fiscal year 1984 request includes funding for: repayment of the loans extended by the Federal Financing Bank (FFB) for TDRSS development; operations payments to the TDRSS contractor; manpower and services necessary to operate and maintain the NASA elements of the network; systems engineering, logistics, and documentation support services to the network elements; and testing for compatibility and interface verification with user spacecraft such as Space Telescope.

The first TDRS satellite (TDRS–A) was part of the payload aboard the STS–6 launch in April 1983. However, the inertial upper stage (IUS), whose purpose was to launch TDRS–A into geosynchronous orbit, launched the satellite into a wrong orbit.

CONSTRUCTION OF FACILITIES—$142,100,000

The Committee authorizes $142,100,000 for construction of facilities, $8,400,000 below the administration request. This authorization is for the following purposes:

(1) Space Shuttle facilities at various locations as follows:

(A) Modifications for additional chillers for mission control center, Lyndon B. Johnson Space Center, $2,300,000;

(B) Modifications to mobile launch platform, John F. Kennedy Space Center, $27,300,000; and

(C) Modification of manufacturing and final assembly facilities for external tanks, Michoud Assembly Facility, $11,700,000;

(2) Space Shuttle payload facilities at various locations as follows:

(A) Construction of cargo hazardous servicing facility, John F. Kennedy Space Center, $9 million; and

(B) Modifications to spacecraft assembly and encapsulation facility for cargo processing, John F. Kennedy Center, $3 million;

(3) Construction of frequency standards laboratory, Jet Propulsion Laboratory, $2,700,000;

(4) Modifications to space flight operations facility, Jet Propulsion Laboratory, $1,600,000;

(5) Construction of fluid mechanics laboratory, Ames Research Center, $3,900,000;
(6) Construction of aeronautical tracking facility, Hugh L. Dryden Flight Research Facility, $800,000;
(7) Modifications and addition for composite materials laboratory, Langley Research Center, $5,100,000;
(8) Modifications to 30-by 60-foot wind tunnel, Langley Research Center, $4,400,000;
(9) Modifications for small engine component testing facility, Lewis Research Center, $7 million;
(10) Modifications to icing research tunnel, Lewis Research Center, $3,600,000;
(11) Relocation of 26-meter STDN antenna, Spain, $1,700,000;
(12) Repair of facilities at various locations, not in excess of $500,000 per project, $19,500,000;
(13) Rehabilitation and modification of facilities at various locations, not in excess of $500,000 per project, $24,500,000;
(14) Minor construction of new facilities and additions to existing facilities at various locations, not in excess of $250,000 per project, $4,800,000; and
(15) Facility planning and design not otherwise provided for, $9,200,000.

The construction of facilities (CoF) appropriation provides for contractual services for repair, rehabilitation and modification of existing facilities; the construction of new facilities; the acquisition of related facility equipment; the design of facilities projects and advance planning related to future facilities needs.

The funds requested for 1984 provide for: the continuation of piror year's endeavors in meeting the facilities requirements for the Space Shuttle; Space Shuttle payload support operations; modification of aeronautical research and development facilities; repair, rehabilitation, and modification of other facilities to maintain, upgrade and improve the usefulness of the NASA physical plant; minor construction of new facilities; and facility planning and design activities.

The projects and amounts in the budget estimate reflect Space Shuttle and Space Shuttle payload requirements that are time sensitive to meet specific milestones. Other program requirements for 1984 include the modification for additional chillers at Johnson Space Center; construction of frequency standards laboratory and modifications to space flight operations facility at Jet Propulsion Laboratory; construction of fluid mechanics laboratory at Ames Research Center; construction of aeronautical tracking facility at Dryden Flight Research Facility; modifications for small engine component testing and modification to icing research tunnel at Lewis Research Center; and relocation of 26-meter STDN antenna, Spain.

The projects and amounts in the budget estimate reflect Space Shuttle payload requirements that are time sensitive to meet specific milestones. Other program requirements for 1984 include the construction of a data analysis facility at the Ames' Dryden Flight Research Facility; rehabilitation and modification of utility systems at the Goddard Space Flight Center and rehabilitation of the airfield at Goddard's Wallops Flight Center; modifications to the tran-

sonic dynamics tunnel and modifications to the 4- by 7-meter low speed tunnel at the Langley Research Center; and, modifications of the 450 PSI air system and modification of rocket engine test facility for altitude testing at the Lewis Research Center.

The fiscal year 1984 program continues to meet the objectives of preserving and enhancing the capabilities and usefulness of existing facilities and to ensure safe economical and efficient use of the NASA physical plant. This request continues the necessary rehabilitation and modification program as in prior years and continues a repair program. The purpose of the repair program is to restore facilities to a condition substantially equivalent to their originally designed capability. The minor construction program continues to provide a means to accomplish smaller facility projects which accommodate changes in technical and institutional requirements.

Committee comments

The NASA request includes $8,400,000 as a reimburesement to the General Services Administration (GSA) for land and facilities at Ellington Air Force Base, Tex. that NASA's Johnson Space Center has used since 1961 for aircraft operations and for astronautical flying proficiency programs. In 1974, Ellington Air Force Base declared the land and facilities excess.

The Committee's position is that NASA should assume title to the land and facilities in question without the transfer of the $8,400,000 and that an intragovernment tranfer of this nature is unwarranted.

RESEARCH AND PROGRAM MANAGEMENT—$1,247,500,000

The Committee authorizes $1,247.5 million for research and program management as requested.

Summary of budget plan by function

Personnel and Related Costs	$883,785,000
Travel	25,700,000
Operation of Installation	338,015,000
Facilities Services	−186,488,000
Technical Services	−59,257,000
Management and Operations	−92,270,000
Total	1,247,500,000

The research and program managment appropriation funds the performance and management of research, technology and test activities at NASA installations, and the planning, management and support of contractor research and development tasks necessary to meet the Nation's objectives in aeronautical and space research. Objectives of the efforts funded by the research and program management appropriation are to (1) provide the technical and management capability of the civil service staff needed to conduct the full range of programs for which NASA is responsible, (2) maintain facilities and laboratories in a state of operational capability and manage their use in support of research and development programs, and (3) provide effective and efficient technical and administrative support for the research and development programs. More than 21,200 civil service personnel at eight installations and headquarters are funded by the research and program managment ap-

propriation. This civil service workforce is NASA's most important resource and is vital to future space and aeronautics research activities. Seventy percent of the research and program management appropriation is needed to provide for salaries and related costs of this civil service workforce. About 2 percent is for travel, which is vital to successfully manage the agency's in-house and contracted programs. The remaining amount of the research and program management appropriation provides for the research, test and operational facility support, and for related goods and services necessary to successfully operate the NASA installations and to efficiently and effectively accomplish NASA's approved missions.

Committee comments

The Committee approved the $1,247,500,000 administration budget request for research and program management for fiscal year 1984.

Estimated Costs

In accordance with paragraph 11(a) of rule XXVI of the Standing Rules of the Senate and section 403 of the Congressional Budget Act of 1974, the Committee provides the following cost estimate, prepared by the Congressional Budget Office:

U.S. Congress,
Congressional Budget Office,
Washington, D.C., April 29, 1983.

Hon. Bob Packwood,
Chairman, Committee on Commerce, Science and Transportation, U.S. Senate, 508 Dirksen Senate Office Building, Washington, D.C.

Dear Mr. Chairman: Pursuant to Section 403 of the Congressional Budget Act of 1974, the Congressional Budget Office has prepared the attached cost estimate for S. 1096, the National Aeronautics and Space Administration Authorization Act, 1984.

Should the Committee so desire, we would be pleased to provide further details on this estimate.

Sincerely,

Alice M. Rivlin,
Director.

Congressional Budget Office Cost Estimate

1. Bill number: S. 1096.

2. Bill title: National Aeronautics and Space administration Authorization Act, 1984.

3. Bill status: As ordered reported by the Senate Committee on Commerce, Science and Transportation, April 21, 1983.

4. Bill purpose: Title I of the bill authorizes the appropriation to the National Aeronautics and Space Administration (NASA) of $7,278 million for fiscal year 1984: $5,888 million for research and development, $142 million for construction of facilities, and $1,248 million for research and program management. The authorization for research and development includes $2,022 million for space shuttle development, $1,536 million for space flight operations,

$559 million for physics and astronomy, $321 million for space applications, $328 million for aeronautical research, and $700 million for a tracking and data relay satellite system. The space shuttle development authorization provides for the production of structural spares and for the initial costs of procuring a fifth shuttle orbiter. Title I also authorizes such sums as may be necessary for increases in pay, retirement, and other employee benefits. Further, the bill probibits the President from commercializing any of NASA's expendable launch vehicle technology without Congressional approval.

The amounts authorized are $172 million higher than the President's fiscal year 1984 budget request for NSA and $439 million higher than 1983 appropriations for the agency to date.

In addition, Title II of the bill authorizes a 1984 appropriation of $29 million for the National Oceanic and Atomospheric Administration (NOAA) to finance operations for the land remote sensing satellite system (LANDSAT) and to provide storage for a second land scanning satellite. This section of the bill also prohibits the transfer of any land, meteorological, or ocean sensing space satellite to the private sector without Congressional approval.

5. Estimated cost to the Federal Government:

[By fiscal years, in millions of dollars]

	1984	1985	1986	1987	1988
Estimated authorization level:					
NASA-Civilian Space Program (Function 250)	6,661	.....	.....	.....	.....
NASA-Aeronautics (Function 400)	617	.....	.....	.....	.....
NASA-Allowance for Pay Increase (Function 920)	48	.....	.....	.....	.....
NOAA (Function 300)	29	.....	.....	.....	.....
Total	7,355	.....	.....	.....	.....
Estimated outlays:					
NASA-Civilian Space Program (Function 250)	4,961	1,472	210	16	2
NASA-Aeronautics (Function 400)	405	163	36	11	2
NASA-Allowance for Pay Increase (Function 920)	46	2	.....	.....	.....
NOAA (Function 300)	20	9	.....	.....	.....
Total	5,432	1,646	246	27	4

Basis of estimate: The estimate assumes that the full amounts authorized will be appropriated prior to the beginning of fiscal year 1984. It also includes $48 million to reflect CBO's baseline estimate of a 5.5 percent federal pay increase for 1984. Estimated outlays are based on historical spending patterns for the major NASA programs.

6. Estimated cost to State and local governments: None.

7. Estimate comparison: None.

8. Previous CBO estimate: On April 19, 1983, the Congressional Budget Office prepared a cost estimate for H.R. 2065, the National Aeronautic and Space Administration Act of 1984, as ordered reported by the House Committee on Science and Technology, April 15, 1983. The House Committee bill authorized appropriations totalling $7,343 million in 1984, $10 million less than S. 1096.

9. Estimate prepared by: Charles Essick.

10. Estimate approved by: James L. Blum, Assistant Director, for Budget Analysis.

Regulatory Impact Statement

In accordance with paragraph 11(b) of rule XXVI of the Standing Rules of the Senate, the Committee provides the following evaluation of the regulatory impact of the legislation:

This bill authorizes the appropriation of funds for the conduct of space and aeronautical research and development activities to carry out the policy and purpose of the National Aeronautics and Space Act of 1958. These activities are conducted in NASA laboratories by NASA personnel and through contracts with industry, universities and research institutions for research and development and for supporting scientific and technical services. The Committee has concluded the nature of these activities is such that there is no regulatory impact on individuals and businesses and, no effect on Federal paperwork or individual privacy.

Section-by-Section Analysis

TITLE I

Section 1. The first section states the short title of the bill, the "National Aeronautics and Space Administration Authorization Act, 1984".

Section 101

An authorization of $7,278.1 million is provided as follows:

(a) $5,888.5 million for "Research and Development";

(b) $142.1 million for "Construction of Facilities"; and

(c) $1,247.5 million for "Research and Program Management".

Section 102

Authorization is provided for an increase in the "Construction of Facilities" funds of up to 10 percent, at the discretion of the NASA Administrator, and 25 percent, following a report to the Senate and House authorization committees justifying the increase.

Section 103

Up to ½ of 1 percent of the funds appropriated for research and development may be transferred to construction of facilities. This amount then may be added to $10 million of the construction of facilities appropriations for additional construction of facilities and land acquisition, if the NASA Administrator justifies the expenditure.

Section 104

No appropriations may be used for any program deleted by Congress and no appropriations may exceed the amount authorized for that particular program in research and development and research and program management. For NASA to obtain funding for programs not presented to the Senate and House in the routine manner, NASA must first prepare a report justifying the proposal. Then, 30 days must elapse after receipt by the Senate and the House of this report or, the Senate and House authorization com-

mittees must approve in writing the proposal within 30 days of receipt of the report.

Section 105

Consideration shall be given to geographical distribution of Federal research funds whenever feasible.

Section 106

Funding is provided for the structural and component spares and the critical engine spares for the current four-orbiter Space Shuttle fleet and for the initiation of procurement of a fifth orbiter.

Section 107

The Senate and House authorization committees must approve any decision and proposed policy of the Administration to commercialize the expendable launch vehicles.

Section 108

Title III of the National Aeronautics and Space Act of 1958 is amended to protect NASA's name and initials against false advertising and related misuse.

TITLE II

Section 201

$29.336 million is provided in fiscal year 1984 to operate the land remote sensing satellite system and to store a backup satellite.

Section 202

The Senate and House authorization committees must review and approve any attempt to transfer the ownership or management of the civil remote sensing satellite system.

CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new material is printed in italic, existing law in which no change is proposed is shown in roman):

NATIONAL AERONAUTICS AND SPACE ACT OF 1958

TITLE III OF THAT ACT

APPROPRIATIONS

SEC. 309. * * *

MISUSE OF AGENCY NAME AND INITIALS

SEC. 310. (a) No person (as defined by section 305) may (1) knowingly use the words "National Aeronautics and Space Administration" or the letters "NASA", or any combination, variation, or colorable imitation of those words or letters either alone or in combination with other words or letters, as a firm or business name in a

manner reasonably calculated to convey the impression that such firm or business has some connection with, endorsement of, or authorization from, the National Aeronautics and Space Administration which does not in fact exist; or (2) knowingly use those words or letters or any combination, variation, or colorable imitation thereof either alone or in combination with other words or letters in connection with any product or service being offered or made available to the public in a manner reasonably calculated to convey the impression that such product or service has the authorization, support, sponsorship, or endorsement of, or the development, use, or manufacture by or on behalf of, the National Aeronautics and Space Administration which does not in fact exist.

(b) Whenever it appears to the Attorney General that any person is engaged in an act or practice which constitutes or will constitute conduct prohibited by subsection (a), the Attorney General may initiate a civil proceeding in a district court of the United States to enjoin such act or practice. Such court shall proceed as soon as practicable to the hearing and determination, enter such restraining orders or prohibitions, or take such other action as is warranted, to prevent injury to the United States or to any person or class of persons for whose protection the action is brought.

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